

TARGET SKILLS

- Performing and recording
- Analyzing and interpreting

CAUTION Wear impact-resistant safety goggles. Also, do not stand close to other people or equipment while doing these activities.

Race to the Ground 

If your school has a vertical acceleration demonstrator, set it up to make observations. If you do not have a demonstrator, devise a method for launching one object, such as a small metal ball, in the horizontal direction, while at the same instant dropping a second object from exactly the same height. Perform

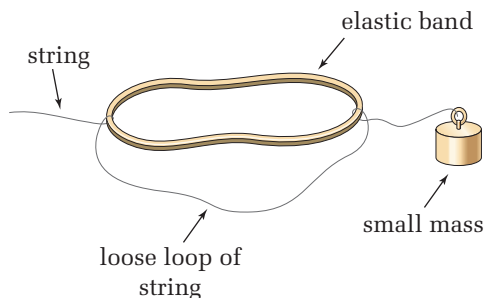
several trials, observing the paths of the objects very carefully.

Analyze and Conclude

1. Describe in detail the paths of the two objects. Compare the motion of the two objects.
2. Which object hit the floor first?
3. Did the horizontal motion of the first object appear to affect its vertical motion? Explain your reasoning for your conclusion.

Feel the Force 

According to the law of inertia, objects must experience an unbalanced force to change the direction of their motion. What does this suggest about an object moving in a circle? Assemble the apparatus as shown in the diagram to obtain information on the forces involved in circular motion. Gently swing the mass in a horizontal circle. Carefully increase the speed of rotation and observe the effect on the elastic band and the path of the object. Change the angle so that the object moves first in an inclined plane and then in a vertical plane and repeat your observations.

**Analyze and Conclude**

1. How does the force exerted on the object by the elastic band change as the elastic band stretches?
2. How does the force exerted on the object change as the speed of the mass increases?
3. Sketch free-body diagrams showing the forces acting on the object as it moves in a
 - (a) horizontal plane
 - (b) vertical plane (at the top of the swing, the bottom of the swing, and when it is at one side of the circle)
4. Describe and attempt to explain any other changes you observed in the object's motion as its speed varied.
5. Was there any difference in the force exerted by the elastic band at the highest and lowest points of the mass's path when it moved in a vertical plane? If so, suggest an explanation.